

Claims

What is claimed is:

1. A process for determining the tension in a moving web, comprising the steps of:
providing a web moving at a determined speed, the web having a determined
basis weight;

5 creating a wave in the moving web;
determining the speed of the propagation of the wave; and
determining the tension on the moving web through a mathematical relationship
between the wave speed, the basis weight of the web, and the speed of the web,
wherein the instability index of the web is greater than or equal to 0.5.

2. The process for determining the tension in a moving web of claim 1, wherein the
tension of the web is between about 10 Nt/m and about 35 Nt/m, and the speed of the
web is about 25 m/s, and the basis weight of the web is about 15 gsm.

3. The process for determining the tension in a moving web of claim 1, wherein the
instability index of the web is greater than about 0.8.

4. The process for determining the tension in a moving web of claim 1, wherein the
step of creating a wave in the moving web is accomplished by an air pulse on the web.

5. The process for determining the tension in a moving web of claim 4, wherein the

step of determining the speed of the propagation of the wave is accomplished by the use of two laser displacement transducers which each provide a signal and are also configured for measuring the speed of the web.

6. The process for determining the tension in a moving web of claim 5, wherein the air pulse is controlled by a computer, and the signals from the two laser displacement transducers are controlled and analyzed by the computer.

7. The process for determining the tension in a moving web of claim 6, wherein the signals from the two laser displacement transducers are bandpass filtered, and then differentiated.

8. The process for determining the tension in a moving web of claim 7, wherein the signals are mathematically cross-correlated to determine the time delay between the signals generated by the two laser displacement transducers.

9. A process for producing a paper web having substantially uniform properties, comprising the steps of:

providing a moving paper web;

5 determining the tension on the paper web while the web is moving; and

adjusting a process condition of the web that affects modulus based on the determined tension to produce a web having more uniform properties, wherein the instability index of the web is greater than or equal to 0.5.

10. The process for producing a paper web of claim 9, wherein the step of determining the tension on the paper web is accomplished in part by use of an air pulse onto the moving web.

11. The process for producing a paper web of claim 9, wherein the step of determining the tension on the paper web comprising the steps of:

creating a wave in the moving paper web;

5 determining the speed of the propagation of the wave;

calculating the tension on the moving web through a mathematical relationship between the wave speed, the basis weight of the paper, and the speed of the web.

12. The process for producing a paper web of claim 9, wherein the tension that is determined on the web is between about 10 Nt/m and about 35 Nt/m, and the speed of the moving web is about 25 m/s, and the basis weight of the web is about 15 gsm.

13. The process for producing a paper web of claim 9, wherein the step of determining the tension on the moving web occurs when the instability index of the web is about 0.8 or higher.

14. The process for producing a paper web of claim 11, wherein the step of creating the wave is accomplished by subjecting the web to an air pulse; and the step of determining the speed of propagation of the wave is accomplished by the use of two

laser displacement transducers which each provide a signal and which also are
5 configured for measuring the speed of the web.

15. The process for producing a paper web of claim 9, wherein the process condition
is selected from the group consisting of:

- time to change doctor blades,
- draw on a winder to maintain uniform tension in each section of the web,
- 5 tension in wound roll of the web,
- flow adjustment to control cross directional dryer coating of the web,
- control of cross directional moisture profile based on a given basis weight profile
and a single point moisture,
- control of cross directional basis weight based on a given moisture profile and an
10 average basis weight from a softroll weight,
- control of the web during turn-ups by optimizing sequence to maintain a desired
tension,
- control of the web during turn-ups by chemical addition to maintain a desired
tension,
- 15 control of the web instability by adjusting stabilizing foils in response to the
instability index calculated from the tension measurement,
- control of the web instability by creping chemistry in response to the instability
index calculated from the tension measurement,
- control of the web handling by keeping the instability index in a desired range by

- 20 adjusting creping chemistry at a certain web speed, and
 control of the web handling by adjusting foil positions to maintain runability at a
 given web speed based on the instability index.
16. A process for controlling a moving web, comprising the steps of:
 providing a web moving at a determined speed, the web having a determined
basis weight;
 generating a wave in the moving web;
5 measuring the speed of the wave in the web; and
 determining the instability index where the instability index is in a desired range
being between about 0.6 and 1.0.
17. The process for controlling a moving web of claim 16, wherein the desired range
is between about 0.6 and about 0.9.
18. The process for controlling a moving web of claim 16, wherein the desired range
of the instability index is between about 0.8 and 1.0.
19. The process for controlling a moving web of claim 16, wherein the desired range
of the instability index is between 0.7 and 1.0.
20. A process for producing a paper web having substantially uniform properties,

comprising the steps of:

providing a moving paper web;

determining the tension on the paper web while the web is moving, wherein the

5 instability index of the web is greater than or equal to 0.5;

adjusting cross directional dryer coating of the web based on the determined
tension of the web; and

adjusting creping chemistry based on the instability index.

21. The process for producing a paper web of claim 20, wherein the step of
continuing to determine the tension on the moving web occurs when the instability
index of the web is about 0.8 or higher.

22. A process for producing a paper web having at least two flows of different
strengths, comprising:

providing a moving layered paper web;

providing at least one hardwood flow and at least one softwood flow to form at

5 least one hardwood layer and at least one softwood layer of the paper web;

determining the tension on the paper web while the web is moving;

controlling the tension of the paper web by increasing the hardwood flow and
decreasing the softwood flow in regions of high tension while maintaining a uniform
basis weight, and by increasing the softwood flow and decreasing the hardwood flow in

10 regions of low tension while maintaining a uniform basis weight, such that the tension is uniform.

23. The process for producing a paper web of claim 22, wherein the instability index of the web is greater than or equal to 0.5.

24. The process for producing a paper web of claim 23, wherein the instability index of the web is between about 0.8 and 1.0.